

THE MINERAL INDUSTRY OF ANGOLA

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The Republic of Angola had a population of about 11 million in a 1,246,700-square-kilometer (km²) area. The area includes Cabinda, which is a coastal strip 100-kilometers (km) wide and 150-km long that is located between the Republic of the Congo [Congo (Brazzaville)] and the Democratic Republic of the Congo [Congo (Kinshasa)]. The mineral economy of Angola was dominated by petroleum, and diamond was another important source of revenue. Petroleum accounted for 45% of the gross domestic product (GDP) and more than 90% of exports. Angola's GDP based on purchasing power parity was estimated to be \$32 billion and the per capita GDP was estimated to be \$2,201 in 2003. Despite increased oil production in 2003, the real GDP growth rate was reported to be only 3.4%. The excessively high inflation rate was reduced to less than 50% in 2003 from 325% in 2001 (International Monetary Fund, 2004§;¹ U.S. Central Intelligence Agency, 2003§).

According to the International Monetary Fund (2003§), the country had a favorable merchandise trade balance of payments in 2002 (the latest year for which data was available) of \$4.65 billion based on export values of \$8.36 billion, of which crude oil exports accounted for \$7.56 billion; diamond, for \$638 million (at an average value of \$127 per carat); and refined petroleum products, for \$95 million. Merchandise imports were valued at \$3.71 billion. The major export trading partners, in terms of value of trade, were the United States (42%), the European Union (29%), and China (19%). The major import trading partners were the United States (42%), the European Union (38%), and South Africa (12%).

Commodity Review

Industrial Minerals

Diamond.—Despite the civil war and United Nations sanctions against illegally mined diamond, officially reported diamond production between 2001 and 2003 averaged about 5 million carats per year. As a result of the end of the civil war in 2002, official diamond production was expected to increase by 2 to 3 times during the next several years. Actual Angolan diamond production, however, was expected to decline slightly in 2003 and 2004 in response to the Government's efforts to deport foreign miners (primarily from Congo [Kinshasa]) who were illegally exploring for, producing, and smuggling diamond from the northern provinces.

Sociedade Miniera de Catoca Ltda. (SMC) remained the leading producer with an output of about 2.8 million carats from its Catoca kimberlite pipe, which is located 35 km south of Saurimo. SMC was a joint venture of Empresa Nacional de Diamantes de Angola (Endiama) (32.8%), Joint Stock Company Almazy Rossii-Sakha (ALROSA) of Russia (32.8%), Odebrecht Mining Services Inc. of Brazil (18.4%), and the Leviev Group of Israel (16%). SMC planned to invest more than \$50 million between 2002 and 2005 to increase production capacity to 7 million metric tons per year of ore, which was expected to yield more than 4.8 million carats per year and to increase the company's annual revenues by \$300 million to \$350 million. ALROSA was building a 16-megawatt hydropower plant on the Chikapa river that would furnish electricity to the Catoca mine. Estimates of reserves in the Catoca kimberlite were reported to be 271 million metric tons of ore containing 189.3 million carats of diamond (Pravda, 2002§; Sociedade Miniera de Catoca Ltda., 2002a§, b§; Antwerp Facets News Service, 2003§).

The exploration rights of De Beers Angola Prospecting Ltd. (a wholly owned subsidiary of De Beers Consolidated Mines Ltd.) had been suspended in May 2001. Previously, De Beers had discovered 17 new kimberlites in its concession areas in Lunda Norte and Lunda Sul Provinces. In late 2002, negotiations between De Beers and the Angolan Ministry of Mines and Geology were reopened and were extended repeatedly through 2003 (Crankshaw, 2003; De Beers Group, 2003).

In September 2002, the Trans Hex Group Ltd. of South Africa acquired a 30% interest in two alluvial diamond concessions at Luarica and Fucuama, which had total diamond resources estimated to be 1.7 million carats. The Luarica diamond mine was opened in 2003 and the startup of production at Fucuama was scheduled for 2004. Trans Hex's partners on the projects included Endiama (40%) and the local companies Micol and Som Veterang (12.5% each). The Luarica mine was expected to yield 800,000 carats of diamond valued at an estimated \$170 million during its first 5 years of operation (African Mining, 2003§; Trans Hex Group Ltd, 2003§).

The Camafuca Operating Joint Venture, which comprised Endiama, SouthernEra Resources Ltd. of Canada, and Welox Ltd. of Israel continued its efforts to incorporate as Sociedade Mineira do Camafuca, Ltda. SouthernEra, which had completed the Phase I feasibility study on the Camafuca-Camazamba kimberlite project in 2001, had a free 18% carried interest in the joint venture. SouthernEra had estimated that the total resources at Camafuca to a depth of 145 meters were 210 million cubic meters at an average grade of 0.111 carat per cubic meter and contained 23.24 million carats of diamond. An initial 5-year-long Phase I project would remove 6.13 million cubic meters of dredged material containing an average grade of 0.18 carat per cubic meter, which would yield 220,000 carats per year with a projected value of \$117 per carat. Dredged material will be moved by a slurry pipeline to a land-based conventional dense-media separation plant. The estimated capital cost of the project was \$25 million, which will be contributed by Welox (SouthernEra Resources Ltd., 2002§; 2003§).

¹References that include a section mark (§) are found in the Internet References Cited section.

In 2003, following a 4-year forced closure, Petra Diamonds and partners Endiama and Moyoweno Ltda., which was a private Angolan company, resumed exploration work on the Alto Cuilo project in Lunda Norte Province, where Petra had discovered a kimberlite pipe in 1998. In June, Petra announced the discovery of three additional kimberlites. A drill program to evaluate the kimberlites was scheduled for 2004.

DiamondWorks Ltd. of Canada retained interest in the Yetwene alluvial diamond project, which had been maintained on a care-and-maintenance basis since November 1999. Sociedade de Desenvolvimento Mineiro de Angola, S.A.R.L., which was a joint venture of Endiama and Odebrecht, held an 85,600-km² alluvial diamond concession in the Cuango River Valley near the town of Luzamba in northeastern Angola. The operations included the Tázua alluvial mine and a final recovery plant at Luzamba. In 2003, diamond valued at \$177 million was produced, but the concession was expected to be mined out in 2004 (Partnership Africa Canada, 2004§).

Negotiations concerning the Heads of Agreement among Endiama, International Defense and Security Forces Resources NV (IDAS) of the Netherlands Antilles (which was a wholly owned subsidiary of American Mineral Fields, Inc. of Canada), and Twins Ltd. of Angola continued through 2003. IDAS held an interest in the Cuango River area prospecting license and a mining license in the Cuango Valley (American Mineral Fields, Inc., 2003§; Adastra Minerals Inc., 2005§).

In late December, New Millennium Resources NL of Australia acquired 100% interest in Angola Resources Pty. Ltd., a company that held 34% interest in the Lapi diamond project (Concession C9) with partners Endiama (51%) and Mombo Lda. (15%). Other companies involved in diamond exploration, production, and/or prospect development in Angola included Associacao Chitotolo, which was owned by Sociedade Mineira de Lumanhe (50%), ITM Mining Ltd. (35%), and Endiama (15%); Sociedade Mineira do Cuangoi Lda., which was a joint venture of Endiama, ITM, and Lumanhe; and a joint venture between Sociedade Mineira do Lucapa (51%) and Sociedade Portuguesa de Empreendimentos (49%), which operated several alluvial projects in the Lunda Norte and Lunda Sud Provinces, including the Calonda, Lucapa, and Mufuto projects.

Mineral Fuels

Petroleum and Natural Gas.—The oil industry was beginning to move into the production development phase following the highly successful offshore deepwater petroleum exploration programs of the past 6 years (1996-2002). Major international oil companies that held oil production-sharing agreements or operated in joint-venture consortia with the state-owned Sociedade Nacional de Combustiveis de Angola (Sonangol) included BP p.l.c., ChevronTexaco Corp., Eni SpA, Exxon Mobil Corp., Norsk Hydro ASA, the Royal Dutch/Shell Group, Statoil ASA, and Total S.A. (formerly TotalFinaElf S.A.). Although, historically, nearly two-thirds of oil production came from ChevronTexaco's block 0, new deepwater discoveries in blocks 14, 15, 17, 18, and 31 will significantly expand production when the oil deposits are developed.

BP continued to plan for the proposed Greater Plutonio project, which would develop the Cobalto, Cromio, Galio, Paladio, Platina, and Plutonio oilfields in block 18. BP expected to award construction contracts in 2004. BP also announced that the successful Marte-1 exploration well resulted in a new oil discovery on block 31.

ChevronTexaco awarded contracts for the development the Belize, Benguela, Lobito, and Tomboco oilfields in block 14. Initial production from the Belize and Benguela Fields was expected in late 2005. ChevronTexaco also proceeded with the Angola LNG project, which was proposed to develop a 4-million-metric-ton-per-year-capacity liquefied natural gas train near Soyo (ChevronTexaco Corp., 2003).

In 2003, Esso Exploration Angola (Block 15) Ltd, which was a subsidiary of ExxonMobil, initiated production of about 80,000 barrels per day (bbl/d) of crude oil from the Xicomba oilfield in block 15, and ExxonMobil announced the discovery of three new oil deposits in block 15—the Clochas, the Kakocha, and the Tchihumba. Hyundai Heavy Industries Co. Ltd. started the fabrication of two floating, production, offloading, and storage (FPSO) vessels for the Kizomba A and B oilfields, and ExxonMobil started engineering work on the Kizomba C prospect. Kizomba A was scheduled to come onstream in 2004, Kizomba B in 2006, and Kizomba C in 2007 (Exxon Mobil Corp., 2004, p. 9-10).

In block 17, Total brought the Jasmim Field onstream in 2003. Production from the 8-well Jasmim Field was piped to the Girassol FPSO on block 17. The FPSO processed about 230,000 bbl/d of crude oil from the Firassol and Jasmim Fields. Sonagol authorized the development of the Dalia Field, which also was in block 17. Initial Dalia production was expected in 2006 (Rigzone.com, 2003§).

Delays continued to impede the construction of the proposed 200,000 bbl/d oil refinery at Lobito. Construction of the refinery, which was originally scheduled to be completed in 2006, was expected to continue into 2008 (Xinhua online, 2004§).

An estimated \$20 billion has been scheduled for investment by 2007 in the development of Angola's petroleum resources, with Angola projected to surpass Algeria and Libya to become the second leading oil producer in Africa after Nigeria. Petroleum production was expected to increase to 1.5 million barrels per day (Mbbbl/d) by 2005, to 1.7 Mbbbl/d by 2007, and to 1.9-2.0 Mbbbl/d by 2010 from 730,000 bbl/d in 2001 (Aremu, 2001§; Embassy of Angola, Washington, DC, 2002§). Additional information on the Angolan petroleum sector is available from the U.S. Energy Information Administration (2004§; 2005§).

Outlook

The end of more than 25 years of civil war in 2002 held promise that Angola could finally begin to rebuild its society and economy. Strengthened by the very significant offshore oil discoveries since 1998, the redevelopment of Angola will be based on the development of its rich offshore petroleum endowment and, to a lesser extent, the reopening of access to its land-based diamond resources to new foreign investment. With the end of the civil war, the country may now be able to take advantage of advances in

mineral exploration concepts and technology, which could help evaluate its potential for new metal mining developments, such as copper, iron ore, nickel, and platinum-group metals. The large number of land mines that remained in place since the end of the civil war could be a restraint on geologic fieldwork in some localities.

For additional coverage of the mineral industry of Angola, see the 2000 and 2002 Minerals Yearbooks, Volume III, Mineral Industries of Africa and the Middle East.

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TABLE 1
ANGOLA: PRODUCTION OF MINERAL COMMODITIES¹

Commodity		1999	2000	2001	2002	2003
INDUSTRIAL MINERALS						
Cement, hydraulic	thousand metric tons	350 ^e	350 ^e	350 ^e	350 ^e	597
Diamond ^{2,3}	thousand carats	3,806	4,313	5,159	5,022	5,000
Granite ^e	thousand cubic meters	1,500	1,500	1,500	1,500	1,500
Marble ^e	do.	100	100	100	100	100
Salt ^e	metric tons	30,000	30,000	30,000	30,000	30,000
MINERAL FUELS AND RELATED MATERIALS						
Petroleum:						
Crude	thousand 42-gallon barrels	272,300	273,000	270,100	329,600	321,200
Refinery products ^{e,4}	do.	14,000	14,000	14,000	14,000	14,000
Gas, natural:						
Gross ⁵	million cubic meters	5,800	11,613	-- ²	--	-- ²
Dry	do.	560	560	-- ²	--	-- ²
Liquefied petroleum gas	thousand 42-gallon barrels	1,185	1,626	-- ^r	--	-- ²

^eEstimated; estimated data are rounded to no more than three significant digits. ^rRevised --Zero.

¹Includes data available through September 2004.

²Does not include smuggled production.

³Production was approximately 90% gem and 10% industrial grade.

⁴Includes asphalt and bitumen.

⁵Angola has no natural gas distribution system. Most gas was vented and flared.

TABLE 2
ANGOLA: OIL AND GAS DISCOVERIES AND PROPOSED INVESTMENT FROM 1996-2011^{1,2}

Operating company	Development	Commodity	Capacity	Investment (million dollars)	Startup date	Comments, reserves, etc.
ChevronTexaco Corp. ³	Block 0 - Cabinda	Petroleum	100,000 to 600,000 bbl/d	2,000	2006	Concession extended 2010 to 2030.
Do.	Block 0 - North Nemba	do.	40,000 bbl/d		2001	NA.
ChevronTexaco Corp. ⁴	Block 14 - Kuito	do.	80,000 bbl/d	400	2001	Discovered 1997, 400 Mbbl.
Do.	Block 14 - Kuito Phase 3 Development	do.	55,000 to 85,000 bbl/d	50	October 2001	NA.
Do.	Block 14 - Benguela	do.				Discovered January 1998.
Do.	Block 14 - Landana	do.				Discovered October 1998.
Do.	Block 14 - Landana 2a	do.				Discovered December 2001.
Do.	Block 14 - Belize	do.				Discovered 1998.
Do.	Block 14 - Tombocco	do.				Discovered October 2000.
Do.	Block 14 - Lobito-1X	do.				Do.
Do.	Block 14 - Tombua	do.				Discovered July 2001.
Do.	Block 14 - Gabela-1	do.				Discovered July 2002.
Do.	Benguela/Belize Development	do.	140,000 bbl/d			NA.
Do.	Block 14 - Negage	do.				Discovered December 2002.
Chevron Texaco (32%), Sonangol (20%)	Luanda LNG plant	Natural gas	5 billion cubic meters per year (4Mt/yr)	2,000	2006	Gas processing plant. Angolan natural gas reserves = 270 billion cubic meters.
Summary				6,000	by 2006	Block 14 total = 3 Gbbl.
ExxonMobil Angola ⁵	Block 15 - Kissanje	Petroleum				Discovered 1998.
Do.	Block 15 - Marimba	do.				Do.
Do.	Block 15 - Hungo	do.				Do.
Do.	Block 15 - Dikanza	do.				Do.
Do.	Block 15 - Chocalho	do.				Discovered July 1999.
Do.	Block 15 - Xicomba	do.				Discovered September 1999.
Do.	Block 15 - Xicomba FPSO	do.	80,000 bbl/d		2003	100 Mbbl reserves.
Do.	Block 15 - Mondo	do.				Discovered June 2000.
Do.	Block 15 - Saxi-1	do.				Discovered August 2000.
Do.	Block 15 - Batuque-1	do.				Discovered November 2000.
Do.	Block 15 - Kizomba-A FPSO	do.	250,000 bbl/d	3,100	2004	Develops Hunga and Chocalho fields, 1 Gbbl reserves.
Do.	Block 15 - Kizomba-B FPSO	do.	250,000 bbl/d	3000	2006	Develops Kissanje and Dikanza fields, 1 Gbbl reserves.
Do.	Block 15 - Kizomba-C FPSO	do.			2007	Develops Bataque, Mondo, and Saxi fields.
Do.	Block 15 - Mblumbumba-1	do.				Discovered April 2001.
Do.	Block 15 - Vicango-1	do.				Discovered May 2001.
Do.	Block 15 - Mavacola-1	do.				Do.
Do.	Block 15 - Reco Reco-1	do.				Discovered September 2002.
Sonangol (50%)	Lobito refinery	Petroleum, refined	200,000 bbl/d	3,600	2006	Seeking financing in 2002.
ExxonMobil Angola ⁶	Block 24 - Semba-1	Petroleum				NA.
Summary				NA		Block 15 - 4 Gbbl reserves.
Canadian Natural Resources Ltd ⁷	Block 16	Petroleum				NA.
TotalFinaElf ⁸	Block 17 - Girassol FPSO	Petroleum	200,000 bbl/d	3,000	2001	Discovered 1996, 800 Mbbl.
Do.	Block 17 - Dalia	do.				Discovered 1997.
Do.	Block 17 - Dalia FPSO	do.	225,000 bbl/d	3,400	2006	NA.
Do.	Block 17 - Rosa	do.				Discovered 1998.
Do.	Block 17 - Liro and Rosa FPSO	do.		3,000	2005	Do.
Do.	Block 17 - Tulipa	do.				Discovered June 1999.
Do.	Block 17 - Orquidea	do.				Discovered September 1999.
Do.	Block 17 - Cravo	do.				Discovered October 1999.
Do.	Block 17 - Camelia	do.				Discovered December 1999.

See footnotes at end of table.

TABLE 2--Continued
ANGOLA: OIL AND GAS DISCOVERIES AND PROPOSED INVESTMENT FROM 1996-2011^{1,2}

Operating company	Development	Commodity	Capacity	Investment (million dollars)	Startup date	Comments, reserves, etc.
TotalFinaElf--Continued ⁸	Block 17 - Jasmine	do.				Discovered 2000.
Do.	Block 17 - Perpetua 1	do.				Discovered December 2000.
Do.	Block 17 - Violeta	do.				NA.
Do.	Block 17 - Anturio	do.				NA.
Do.	Block 17 - Zinia-1	do.				Discovered December 2002.
Do.	Block 17 - Hortensia-1	Petroleum				Discovered March 2003.
Do.	Block 17 - Acacia	do.				Discovered March 2003.
TotalFinaElf ⁹	Block 32 - Gidungo-1	Exploration October 2002				NA.
Summary				NA		NA.
BPAmoco ¹⁰	Block 18 - Platina	do.				Discovered 1999.
Do.	Block 18 - Plutonio	do.				Do.
Do.	Block 18 - Plutonio FPSO	do.	220,000 bbl/d		2007	To service 6 blocks, 18 fields.
Do.	Block 18 - Galio	do.				Discovered 2000.
Do.	Block 18 - Paladio	do.				Do.
Do.	Block 18 - Cromio	do.				Discovered October 2000.
Do.	Block 18 - Cobalto	do.				Discovered December 2000.
Do.	Plutonio/Cobalto FPSO		80,000+ bbl/d		2005	400 Mbbl reserves.
Do.	Galio/Cromio Development					300 Mbbl reserves.
BPAmoco ¹¹	Block 31- Plutao 1					NA.
Summary				7,500	by 2011	6 fields, 2.4 Gbbl.
Norsk Hydro ASA ¹²	Block 34	Petroleum				NA.
Angola total		Petroleum	2 Mbbl/d	20,000	2010	NA.
Do.		Natural gas	5 billion cubic meters per year	2,000	2006	NA.

Do Ditto. FPSO Floating production storage and offloading vessel. NA Not available.

¹Blank column indicates no information was available.

²Abbreviations: bbl/d, barrels per day; Gbbl, billion barrels; Mbbl, million barrels; Mt/yr, million metric tons per year.

³Block 0—Chevron Texaco (39.2%), Sonangol (41%), Elf Petroleum Angola (10%), and AGIP Angola Production (9.8%).

⁴Block 14—Cabinda Gulf Oil Co. (ChevronTexaco) (31%), Sonangol Pesquisa e Produção S.A.R.L. (20%), Agip Angola Exploration BV (20%), TotalFinaElf E&P Angola (20%), and Petrogal Exploração (9%).

⁵Block 15—ExxonMobil Angola (40%), BP Exploration (Angola) Limited (26.67%), Agip Angola Exploration B.V. (20%) and Statoil Angola (13.33%).

⁶Block 24—Esso Exploration Angola (Block 24) Limited (50%), Sonangol (20%), Petronas Carigali Overseas SDN BDH (15%) and Ocean Angola Corporation (15%).

⁷Block 16—Canadian Natural Resources Ltd. (50%), Odebrecht Oil & Gas (30%), and Sonangol (20%).

⁸Block 17—TotalFinaElf (35%), ExxonMobil (20%), Sonangol (20%), BP Amoco (6.67%), Den Norske State Oljeselskap a.s. (Statoil) (13.33%), Norsk Hydro ASA (10%), and Petrofina 5%.

⁹Block 32—TotalFinaElf (30%), Sonangol (20%), Prodev (20%), ExxonMobil (15%), Marathon (10%), and Petrogal (5%).

¹⁰Block 18—Amoco Angola B.V. (a wholly owned subsidiary of BP) (50%), and Shell Development Angola B.V. (50%).

¹¹Block 31—BP (26.7%), ExxonMobil (25%), Statoil (13.3%), Marathon (10%), TotalFinaElf (5%), and Sonangol, (20%).

¹²Block 34—Sonangol (20%), Norsk Hydro (30%), Phillips Petroleum (20%), Shell (15%), and Petrobras (15%).

Source: U.S. Geological Survey compilation from published company and Angolan Government data available through October 2003.